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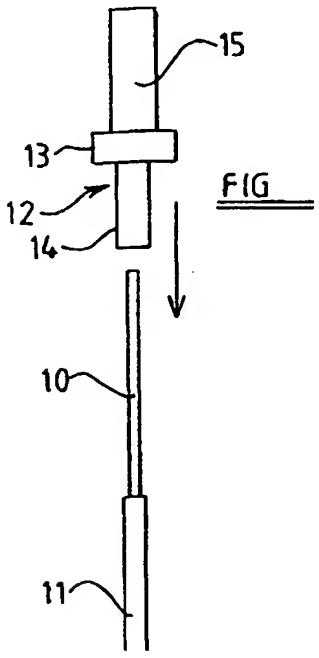
(54) Device for applying heat to an adhesive

(57) A device for applying heat to an adhesive of the type used to set an optical fibre (10) in a termination (12) therefor, the device comprising a portable housing (21), heating means (26, 28) disposed within the housing and holding means (32) for holding the termination in operative relationship with the heating means to promote curing of the adhesive.



FIG

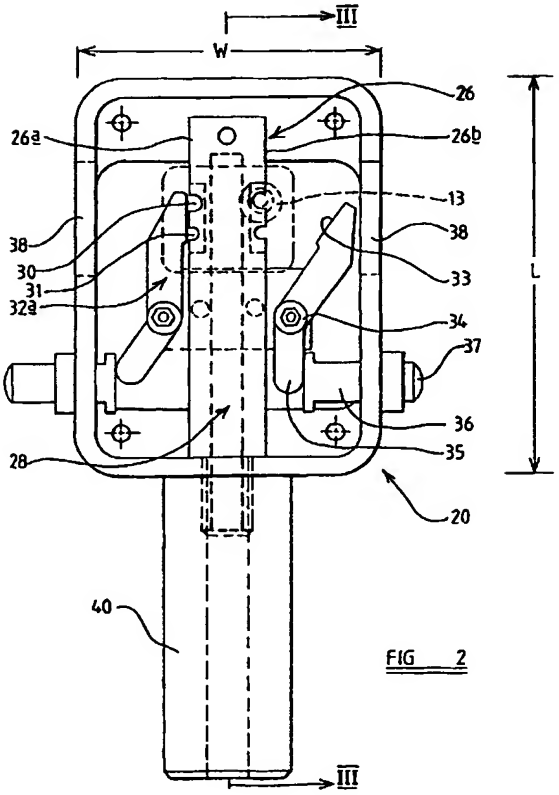


FIG 2

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Description

[0001] This invention relates to a device for applying heat to an adhesive of the type used to set a fibre optic cable in a termination therefor.

[0002] Fibre optic cables are used for the transmission of data, with data transfer being accomplished by the transmission of pulses of light through a fibre comprising a core contained in a cladding having a different refractive index. The fibre typically having a diameter of about 50-300 microns.

[0003] Whilst the fibre may be protected by one or more outer layers, including, for example, a wear resistant sheath, it is necessary to attach the cable to a termination when it is required operatively to connect the fibre with data handling apparatus, or when it is desired to allow light to pass from the fibre into another fibre, at a connector interface.

[0004] Typically, such terminations include a metallic ferrule and a guide, the guide typically being formed from a ceramic material, through which the fibre extends to an optical end surface thereof, with the fibre being set in the guide by adhesive.

[0005] Setting of the fibre in the guide may be accomplished by introducing adhesive into the termination, prior to insertion of the fibre so that when the fibre is introduced, the adhesive is moved along the guide, and usually some of the adhesive is urged from the interior of the guide onto the external end surface. The fibre (and adhesive on the end surface) may then be subjected to a finishing operation such as polishing to ensure that an optically flat surface is obtained.

[0006] Alternatively or in addition, adhesive may be added to the core/guide interface subsequent to the introduction of the fibre, at the end surface.

[0007] In each case, curing of the adhesive needs to occur before any polishing operation can be carried out.

[0008] In view of the strength characteristics which are required of such adhesives, it has become usual in the fibre optics field to employ adhesives of the kind requiring an input of heat for satisfactory curing to be obtained in an acceptable time frame, with the industry standard currently being an adhesive available under the Trade Mark Epo-Tek 353ND.

[0009] Two-part epoxy adhesives such as this require heat to be applied in accordance with a particular temperature/time profile to promote curing, and it has hitherto been necessary to do this by placing the core and termination in a temperature controlled oven. The use of such ovens presents few problems under laboratory conditions, where skilled operators are available. However, where space is limited, or where skilled operators are not available, the application of heat to promote curing may be problematic.

[0010] Such conditions are often present on aircraft, where in situ repairs may be desirable.

[0011] According to one aspect of the present invention, we provide a device for applying heat to an adhesive of the type used to set an optical fibre in a termination therefor, the device comprising a portable housing, heating means disposed within the housing and holding means for holding the termination in operative relationship with the heating means to promote curing of the adhesive.

[0012] Thus the heating means may be used in situ to apply heat to an adhesive during a fibre optic termination method.

[0013] The heating means may comprise a heating member having at least one recess or aperture therein, into or though which a generally rigid guide of the termination may extend, in use.

[0014] The recess or aperture is preferably dimensioned and/or configured so as to receive the guide of the termination in a close fitting manner, such that heat from the heating means may be transferred to the guide quickly and efficiently.

[0015] Preferably, the recess or aperture is provided along an edge portion of the heating member. The recess or aperture may be generally concave.

[0016] Preferably, the heating member comprises a plurality of differently sized or configured recesses or apertures, such that a variety of sizes and types of fibre optic cable terminations may be received therein.

[0017] To provide further versatility, the heating member may be removable from the housing, such that an alternative heating member having recesses or apertures suitable for other shapes/sizes of fibre optic cable terminations, may be inserted.

[0018] The heating member is preferably generally elongate, and the recesses/apertures may be provided along two opposite sides thereof.

[0019] In this way, two or more terminations may be inserted simultaneously to promote curing. It will be appreciated that to accomplish this, two (or more) holding means may be provided.

[0020] The heating member may itself be heated by a heating element which may be electrically powered, and may be located, in use, generally within the heating member.

[0021] The heating element may be releasably attachable to the heating member, conveniently by screw-threaded means. In this way, the heating element may be replaced should it fail or become damaged.

[0022] The holding means may comprise a bearing surface, which, with the holding means in an operative position, bears upon the guide of the termination, urging it into operative relationship with the heating block.

[0023] Preferably, the holding means comprises a clamping member, which may be mounted about a pivot within the housing.

[0024] The clamping member is preferably urged towards its operative position by the action of a spring or other resilient member.

[0025] Conveniently, the bearing surface of the holding means is adapted to hold in operative relation-

ship a termination disposed within any of a plurality of recesses/apertures.

[0026] Preferably, the holding means is moved from its operative position to an inoperative position by the action of an operating member, such as a lever or button, which in use protrudes from the housing, which operating member may be mounted for reciprocating movement relative to the housing.

[0027] Linkage means may be provided to convert reciprocating movement of the operating member to pivotal movement of the holding means.

[0028] The housing may comprise at least one viewing aperture therein, to provide a line of sight to an operator of the device, so that the operator may ensure that correct insertion of the termination has occurred.

[0029] The line of sight may be generally perpendicular to the extent of the fibre optic cable or cables.

[0030] The device is preferably provided with a handle portion, so that movement and positioning of the device may be facilitated.

[0031] This may be particularly advantageous when it is desired to effect a repair to a fibre optic cable in situations where space is limited, such as on board an aircraft. In such circumstances, there is often little or no spare cable available, and it is therefore necessary to effect the repair in situ.

[0032] The housing may also be provided with attachment means to enable it to be secured in position during a curing operation. Again, this may be especially advantageous on board an aircraft, where in situ repairs to hanging and/or relatively inaccessible fibre optic cables may be required.

[0033] Moreover, the attachment means enable the device, once a termination has been inserted, to be left in position whilst curing of the adhesive is promoted.

[0034] Thus, there may be provided a hook and loop fastener arrangement, part of which is attached to the housing. Alternatively, other attachment means such as a hook or a clamp could be utilised.

[0035] Preferably, the device is powered by a relatively low voltage source, such as a 28 (twenty-eight) volt DC power source, commonly found in aircraft electrical systems.

[0036] Thus, power for the device may be obtained directly from such an electrical system, although it will be appreciated that batteries or other charge storage devices could be used to improve the portability of the device, if required.

[0037] So that appropriate curing programmes (i.e. temperature/time profiles) may be employed, the heat applying device, in use, may be operatively connected to a suitable control means.

[0038] The temperature/time profile required will vary in accordance with the particular adhesive used, although in the case of the industry standard, Epo-Tek 353ND, heating the adhesive to a temperature of approximately 100°C for thirty minutes to one hour, has been found to be satisfactory.

[0039] According to a second aspect of the present invention, there is provided a method of setting a fibre of a fibre optic cable in a termination therefor, comprising:

(a) engaging the fibre with the termination;
(b) applying adhesive or causing adhesive to be applied to the fibre and/or termination;
(c) introducing the engaged fibre and termination into a housing containing heating means; and
(d) holding the assembly in operative relationship with the heating means, until curing of the adhesive, promoted by the heating means, has been effected.

[0040] The method described above may involve the use of a device in accordance with one or more of the preceding paragraphs.

[0041] The invention will now be described by way of example only, by reference to the accompanying drawings, wherein:-

FIGURES 1a and 1b illustrate the initial stages in the production of a fibre optic cable/termination;
FIGURE 2 is a plan view of a device in accordance with the present invention, shown with a cover portion removed; and
FIGURE 3 is a cut-away side view of the device of FIGURE 2, taken generally along the line III-III thereof.

[0042] Referring first to Figure 1A, there is shown a fibre optic core 10 located within a protective outer sheath 11, and a termination therefor, generally indicated at 12, comprising a metallic ferrule 13 disposed between concentric rigid guides 14 and 15, with the guide 15 being formed of an electrically non-conducting ceramic material.

[0043] It will be appreciated that the fibre 10 may be surrounded by a plurality of protective layers within the sheath 11, and the fibre 10 is shown with all such layers having been stripped back.

[0044] To bring the termination 12 and fibre 10 into engagement, a projecting part of the fibre 10 is inserted through the guides 14 and 15, and an appropriate quantity of a specified adhesive is used to effect a bond between the fibre 10 and the guide 15.

[0045] This may be effected by applying the adhesive subsequent to the engagement of the fibre 10 and termination 12, resulting in a dome 16 of adhesive being produced at a distal optical end surface of the guide 15, as shown in Figure 1b.

[0046] Suitable adhesives used for such purposes generally comprise two-part epoxy adhesives, such as the type requiring heating to promote post-mix curing.

[0047] In order thus to promote curing in circumstances where it is not possible or practical to provide an oven of the type which is conventionally used in a laboratory, the fibre/termination generally indicated at

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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 1531

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 May 2000	Mathyssek, K

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 10 1531

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82